Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/142
UNITED KINGDOM
February 1964
Original: ENGLISH

Confidential until official release during Conference

Abstract

THE DEVELOPMENT OF BURST CARTRIDGE DETECTION SYSTEMS WITH PARTICULAR REFERENCE TO SIZEWELL NUCLEAR POWER STATION

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Operation of the Calder Hall and Chapel Cross reactors has shown that burst cartridge detection systems must be designed to detect and locate fast and rapid bursts and cavitation failures. The necessity for rapid detection of fast bursts lays emphasis on frequency of scan at the expense of sensitivity. On the other hand, the need to locate channels containing cavitation failures, which contribute to a slow rise in background count, requires the ability to scan the reactor at high sensitivity.

For recent reactors a dual scanning system has been adopted. In this a rapid scan of groups of up to 32 channels provides the routine operational protection and a slow, periodic, scan of individual channels provides a long term record for every channel from which an increasing count can be determined.

In the case of Sizewell the group system is made continuous although the output of the precipitator is presented as a count integrated over a period of about one minute. This reduces the time taken to confirm the existence of a burst and eliminates the need for a selector system, thereby improving reliability of operation.

The reactor refuelling equipment at Sizewell, differs from earlier stations in that charge chutes remain permanently installed in the reactor and guide tubes above the core bring the channel outlets to a configuration suitable for a simple chute. This arrangement enables removable selector valves to be

installed adjacent to the sampling points. These manifold the group samples and operate as selectors for single channel sampling.

The group monitor is provided with high count alarms and only following receipt of such an alarm are the integrator outputs recorded. Data from a single channel scan are recorded on punched cards for subsequent analysis by computer. When the system is being used for burst location, the counts are immediately available to the reactor engineer. Facilities for locking on to particular channels are provided on the basis of 1 facility for every 1000 fuel channels. A bulk gas monitoring system is also provided to back up the other systems, particularly when any channel is not being monitored by a system with alarms.

Advantage has been taken of the existence of a multi-cell precipitation unit developed for the Windscale A.G.R. The performance of the group system was dictated largely by this unit and by the need to keep sample flows small in view of the very large number of samples being taken simultaneously.

The principal items of equipment developed specifically for the Sizewell reactors were the primary and secondary selector valves. The former were required to operate in reactor hot gas conditions with considerable reliability and a minimum of two years between maintenance periods. The secondary valve was developed from the primary valve but is subject to less arduous conditions.

A development of the Sizewell system includes a thermocouple in the primary selector valve enabling the outlet gas temperature of every channel to be measured.